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Biological responses to current fluxes of ultraviolet radiation in High Arctic

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Depletion of the ozone layer and the consequent increase in solar ultraviolet-B radiation (UV-B) may impact living conditions for arctic plants significantly. In order to evaluate how the prevailing UV-B fluxes affect the heath ecosystem at Zackenberg (74°30'N, 20°30'W) and other high-arctic regions, manipulation experiments with various set-ups have been performed. Activation of plant defence mechanisms by production of UV-B absorbing compounds was significant in ambient UV-B in comparison to a filter treatment reducing the UV-B radiation. Despite the UV-B screening response, ambient UV-B was demonstrated to decrease photosynthesis and shift carbon allocation from shoots to roots. Moreover, ambient UV-B increased plant stress with detrimental effects on electron processing in the photosynthetic apparatus. Plant responses did not lead to clear changes in the amount of fungal root symbionts (mycorrhiza) or in the biomass of microbes in the soil of the root zone. However, the composition of the soil microbial community was different in the soils under ambient and reduced UV radiation after three treatment years. These results provide new insight into the negative impact of current UV-B fluxes on high-arctic vegetation. They supplement previous investigations from the Arctic focussing on other variables like growth etc., which have reported no or minor plant responses to UV-B, and clearly indicates that UV-B radiation is an important factor affecting plant life at high-arctic Zackenberg. However, long-time experiments are needed in order to see whether the observed changes are transient or whether they accumulate over years. Such experiments are especially important for valid determination of below-ground responses, which potentially lead to feedbacks on the ecosystem functioning.